A NEW ERA IN AVIATION:

Flying Forward toward a Cleaner, Greener, Safer & Quieter Future

Remarks by
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It's so great to be here among so many friends of aviation. I hope that you'll stick around when I'm through for a NASA panel that features many of my colleagues. Our strong NASA presence here should say something about how seriously we take that first "A" – the big A – in NASA.

There's a real energy here – I'm told we have about 700 people in this room with us today. I think that much of this energy flows from a belief we share and it is this: we are on the cusp of a new era in aviation … an era when aviation will be cleaner, greener, safer, and quieter, even as our aircraft fly significantly faster … an era that will see more of our people working in STEM careers … an era that will see our children and grandchildren inherent a world from our generation that is actually reversing the effects of global climate change.

No matter what shape this era takes – or what shapes the aircraft in our skies will take – surely we can all agree on this: this new era of aviation cannot happen on its own. We have to choose to make it so.

That is why President Obama is proposing an historic $3.7 billion investment in green aviation that will allow us to do some very exciting things when it

comes to revolutionary new aircraft shapes, new propulsion systems, biofuels, fuel efficiency –and so on.

He sees what more and more of us are seeing every day: Green aviation not only makes environmental sense, it saves our businesses a lot of dollars and cents as well.

Even before the President proposed this new investment, NASA discovered after six years of research into green aviation technologies, that we could save the commercial airline industry $255 billion over a 25 year period if those technologies were adopted – and we could reduce emissions by some 900 million tons!

These technologies include advanced, high-efficiency engine designs; new methods for building large, non-circular, pressurized composite structures; and active flow control jets to reduce the size of control surfaces.
Imagine what it could mean to have aircraft flying through our skies that use half as much fuel, emit 75 percent less and are only one eighth as noisy (as today's regulated limits)!

Leonardo Da Vinci, who dreamed all his life about human flight, is purported to have said, *"Once you've tasted flight, you will walk the earth with your eyes turned skyward."* As an aviator myself, I can attest to this. At NASA our eyes are not only focused "starward" but focused skyward.

I think I speak for the entire NASA family when I say that we are all tremendously proud of the fact that every American aircraft and air traffic control tower is equipped with NASA technology.

That's why we like to say, "NASA is with you when you fly." The coda to this is something else we aspire to say as well: NASA is with you when you innovate. NASA is with you when you invent. NASA is with you when you create jobs.

While you work toward the goal of being able to fly across the country in fraction of the time it takes us today … NASA is with you.

While you look for new ways to complete these flight with a fraction of the fuel … NASA is with you, too.

While you work to reshape the future of aviation by reshaping the design of our aircraft … NASA is with you.

While you work toward the goal of saving billions of dollars while also saving our planet … NASA is with you.

When we look out into the atmosphere, I think it's fair to say that most of us see something remarkable happening. All sorts of technologies are coalescing. They are generating incredible breakthroughs in the speed and efficiency of transport aircraft. They are empowering nascent markets for smaller aircraft. They are creating new jobs and turning a new generation of dreamers into entrepreneurs.

Yet, these technologies are not the only things of note that are coalescing. Industry, government, trade organizations, academics, airlines, airports are all coalescing as well – and this cohesion is represented by the hundreds of people right here in this room and the organizations we represent.
If you remember nothing else I say today, I hope you'll remember these two words: "join us."

For more than a century – dating back to our NACA days – NASA's collaboration with industry has allowed America's innovators to do remarkable things … and we're just getting started.

Today, we're collaborating with airlines on technologies geared at doing everything from reducing surface delays, to dynamic weather routing,to cutting down fuel consumption, to optimizing time and fuel savings for pilot-entered route changes.

We're joining with airports, airlines and the FAA on innovations that promise to improve air traffic flow both in the air and on the ground.

There's a great example in a tool we recently transferred to the FAA for full deployment: With Terminal Sequencing and Spacing, air traffic controllers support pilots as they use flight deck automation to fly optimized profile descents, reduce fuel use and noise and improve airport throughput.

That brings me to our New Aviation Horizons initiative – making use of the new investment that President Obama is calling for in aviation, we are returning experimental technology demonstrators to flight. Many of us are fond of the more romantic term used by aviation enthusiasts: X-planes.

We'll fly a series of subsonic X-planes that will look unconventional in many ways, perhaps forever changing the design paradigm of tube and wing aircraft.

By employing technologies such as non-circular fuselages, very high aspect ratio wings and advanced propulsion-airframe integration techniques, these experimental aircraft will demonstrate a new standard for airframe efficiency.

Couple these advances with additional technology development and maturation of ultra-high bypass turbofan engines, and we will have fully validated the ability to develop aircraft that use half the energy and produce half the perceived noise of airplanes flying in the fleet today and we aren't stopping there.

We will also demonstrate hybrid electric propulsion systems that have the potential to extend efficiency beyond these levels and further reduce carbon emissions.
But let's think even beyond that.

Now is the part of our program where I talk about something you don't want to hear – and neither do I … a sonic boom over land!

If you were to sit in our boom simulation facility at Langley Research Center, you might describe the noise less as a "boom" and more as very distant thunder that could go unnoticed in a busy household.

The ability to make this dream into a reality was on full display recently at National Airport in Washington, D.C. when we announced a new collaboration between NASA, Lockheed Martin Aeronautics, GE Aviation and Tri-Models, Inc. on the preliminary design of an X-plane that's designed to travel at supersonic speeds without making a super-loud, sonic boom.

It's called QueSST and we hope it will give regulators here and around the world the data they need to consider changing current rules that ban supersonic flight over land.

I want to reiterate that the one thing at NASA we have absolutely no intention of doing is "going it alone."

I would argue that collaboration among government, industry, entrepreneurs and academic partners is more important now than ever. Why do I say that? I

say so because technology isn't the only thing that's changing. Our world is changing. The reality is that the advances we have made in aviation since our friends Orville and Wilbur first got started have made our world smaller – and while a smaller world is a great thing when it comes to peace, diplomacy and yes – commerce – it also brings with it a new set of global challenges.

Legend has it – and some of you might know this story, or even have heard me tell it before – that Orville Wright at one point got exasperated with explaining to folks how his airplane worked. So he eventually just started telling people that *"it stays up, because it doesn't have time to fall."*

When you look around at how quickly our world is changing – I think there's a powerful metaphor in there. Standing still isn't an option for a pilot that doesn't want her or his plane to fall out of the sky. It's not an option for our country in changing times, either.

When you consider that our skies are projected to grow so crowded in the decades to come that we'll need to be able to accommodate the equivalent of every single one of Earth's 7 billion people taking a flight in a given year … *standing still is not an option.* Especially when you consider that this growth will require more than 36,000 new airplanes, which translates to $4 to $5 trillion dollars in manufacturing.

In times when our global climate is changing … *standing still is not an option.*

In a 21st century world where we're still relying on many legacy 20th century tools, systems, and aircraft designs… *standing still is not an option.*

When you consider the way the new, global innovation economy is taking shape … *standing still is not an option.* It's not an option in times when not enough of our young people are studying the "STEM" fields of science, technology, engineering and math -- and it's certainly not an option when we are looking to close so many unacceptable disparities when it comes to women and people of color.

Last but by all means not least, in times when our global economic competitors are flying forward, standing still is definitely not an option.

It's not an option when China is developing an aircraft to compete on the global market with Boeing's 737. It's not an option when we see our friends in the European Union investing $4.5 billion investment in their Clean Sky

initiative. It's not an option when Brazil, Canada, Russia, Japan and others are stepping up their games as well.

With all this as a backdrop, I'm going to bring back those two magic words: "*join us.*"

Join us as we work together to make sure our aviation system is modern, nimble and efficient enough to meet the new challenges of this new century.

Join us, as we work to make our skies even safer, even as they grow more crowded.

Join on the exciting work I mentioned that's geared toward flying quieter even as we fly faster.

Join us in our work to increase our use of renewable fuels and to decrease emissions into our atmosphere.

Join us as we work to safely integrate unmanned aerial systems into our skies.

Join us in the great work of building an innovation economy that's second to none – while doing the right thing for planet, and with it our children, our grandchildren and the future world they will inherit.

One of the beautiful things about the times in which we live is that the solutions to all these challenges are mutually reinforcing.

Tom Friedman put it especially well a few years ago, when he said in an interview with Newsweek that (and I quote): *"The country that owns green [and] that dominates that industry, is going to have the most energy security, national security, economic security, competitive companies, healthy population and, most of all, global respect … This isn't just about electric power. It's about economic power, it's about national power."* End quote.

We have a remarkable opportunity to "own green" and green aviation is a big part of the reason why. We can save money, save lives and save our planet, if we're willing to choose to invest together, so that we can progress together as a country.

President Obama has set us on a visionary course and it's my sincere hope that future leaders from all sides of the political spectrum see it through.

If we are willing to invest together, to research together, to develop together, and yes – to fly forward together, than I fully believe we'll be able to leave a very, very special gift to our children and grandchildren. Expressed explicitly, that gift includes:

A country where more of our neighbors are working in stable, well-paying jobs … and a future where we fly on aircraft that consume half as much fuel and generate only one quarter of current emissions. A future where flight is fueled by greener energy sources …

A future where our air transportation system is able to absorb nearly four billion more passengers over the next 20 years without compromising the safety of our skies …

A future where our airports are better neighbors because aircraft operate as much as 42 decibels quieter … and noise is contained with in an airport's borders …

A future where people can travel to most cities in the world in six hours or less in an airplane that can fly faster than the speed of sound over land on bio-fuels.

If all this sounds like science fiction, well that's why I like to say that the people of NASA turn science fiction in to science fact. It is why I like to brag about how the men and women of NASA make the impossible possible … and we do it, like Da Vinci said, with our eyes turned skyward. *"For there you have been,"* he said, *"and there you will long to return."*

Thank you all very much. Now I'm going to hand off to our incredible NASA panel members who will give you details on the great content of our New Aviation Horizon.